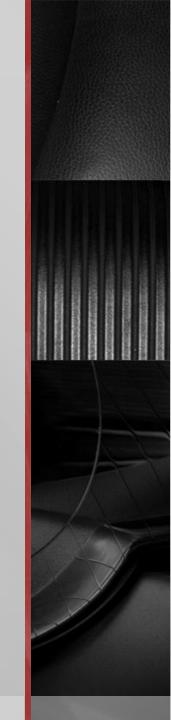
Energy Savings through Building Design

Daviess County Public Schools

Jim Barr, CEM



22 Buildings

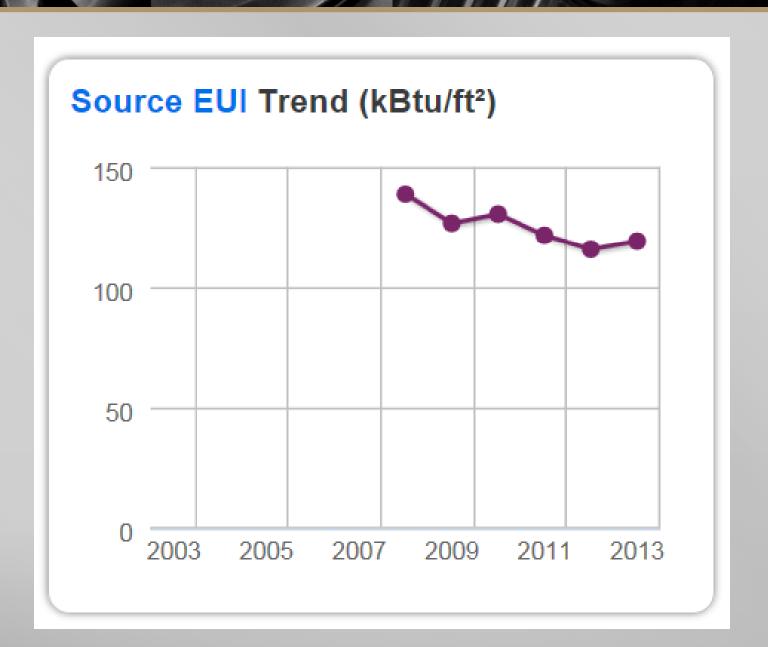
- 2 High schools
- 3 Middle schools
- 12 Elementary schools
- 1 Alternative high school
- 4 Support facilities

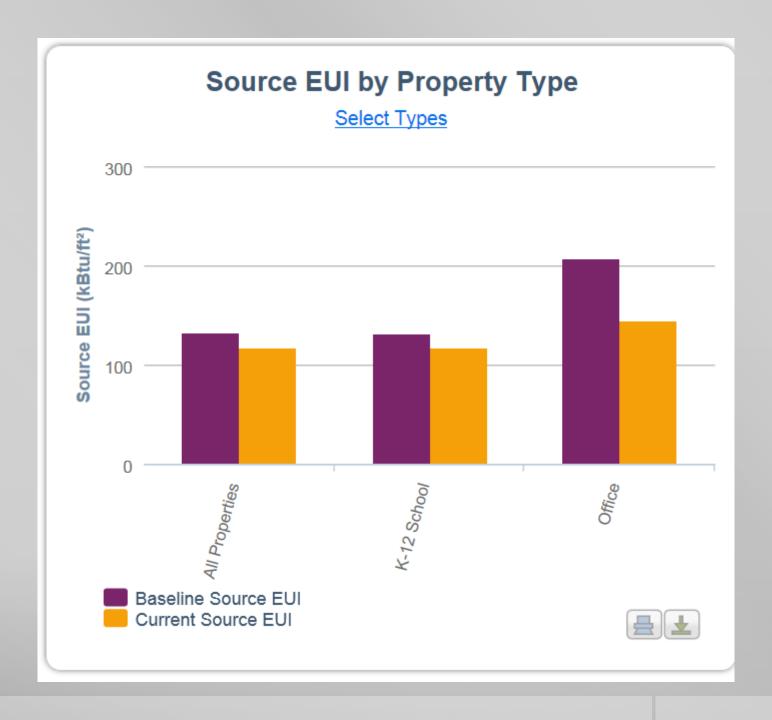
1.6 Million Sq. Ft.

\$1.7 Million for all power in 2013

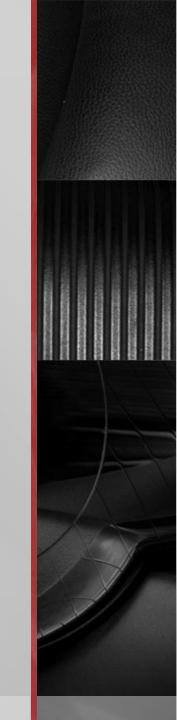
8 Buildings less than 20 years old

- All buildings have been renovated to some extent
- Currently we are focusing on changing mechanical system in our older buildings
- Since 1993 all new buildings have geothermal heat pumps
- 15 Energy Star buildings
- Average ES rating for the district is 78
- Average EUI for the district is 50.7





Energy Savings through Continuous Improvement in Building Design



DESIGN CRITERIA FOR SCHOOLS

Architectural

- Transoms & canopy designs which discourage bird's nests
- Standing seam metal roof
- Wide plumbing chases
- Lawn equipment storage—42" door
- 5. Hollow metal doors and frames (no wood)
- 6. Hall doors recessed (not swinging into walkways)
- No islands, raised curbs, etc. in parking lots to interfere with snow removal
- 8. Minimal shrubbery; prefer trees (ground-cover lava stone)
- 9. Sod around entire building perimeter instead of along pavement
- 10. ADA signage for all rooms that would be visited by parent
- 11. Smoke doors: hold-open with fire alarm
- 12. "Best" cores on all locksets
- 13. Sonitrol security system provided by Owner
- 14. Provide district standard ceiling tile
- Proper drainage away from building downspout leads beneath sidewalk
- 16. Provide French drainage out of playground areas
- 17. Solid vinyl tile in classrooms, computer labs
- 18. Tack strips in hallways
- 19. Watch mounting height of urinals
- 20. Provide allowance for relocating message board sign from existing school
- 21. Custodial workroom with place for desk, phone, computer
- 22. Solid surface restroom partitions with heavy duty hardware
- Provide allowance to relocate playground equipment from existing school
- 24. Block for pencil sharpener (40" from floor)
- 25. Dry marker boards; consult with owner about mounting heights
- 26. Full-length mirror in restrooms
- 27. Toilet tissue holders, soap dispensers, towel dispensers, etc. NIC
- 28. All bids to have DCBE Bid number
- All change orders approved by Board
- 30. Minor deviations documented & confirmed with Project Facilitator
- General Contractor's superintendent to keep daily log; copy to Project Facilitator
- As-built drawings submitted to owner within 180 days of acceptance of building
- 33. Floor plan of building & site plans furnished to owner in CAD format

- 34. Notification from architect that building does not contain ACBM
- 35. Five-year extended warranty on HVAC compressors (parts only)
- 36. Certified check of single-phase protection equipment
- Concrete pads for dumpster (large enough to catch front wheels of truck)
- 38. Metal locator in all utility trenches
- Alerton EMS system provided in contract, full DDC controls throughout building. All programming, displays, and tie-in to owners existing EMS system to be provided by controls contractor.
- 40. Data wiring numbering sequence by owner
- 41. Carpet with moisture resistant backing
- 42. Porcelain tile and sanitary base in all restrooms no VCT
- 43. Cubbies for storage of book bags, backpacks, etc.
- Avoid high glass (difficult to clean)
- 45. All windows with low-E insulated glass
- 46. Washable paint on drywall
- 47. Sequential room numbering system on plans (consult with owner prior to numbering rooms)
- 48. Computer counter height at 28" minimum to finish floor
- Provide for future time-out room: light switch outside room, vandal-proof light fixture, ventilation, no electrical receptacles, door prepped for magnetic lock
- 50. Provide access panel to get behind bleachers

Mechanical

- 51. Geothermal HVAC with variable speed compressors
- Use only two pumps: one for geofield, one for building, each sized to do the whole system as backup. Put both on VFD control
- Use two gas fired instantaneous water heaters in kitchen with high and lower temperature. <u>Circulation pump</u> at kitchen with control wire to EMS.
- 54. HW heaters for restrooms to be air source heat pumps without circulation pumps located on the mezzanine near restroom banks
- 55. Service sink on all mezzanines
- 56. Make-up water on geothermal loop
- 57. Urinals shall have minimum "target" opening of 60 sq. in

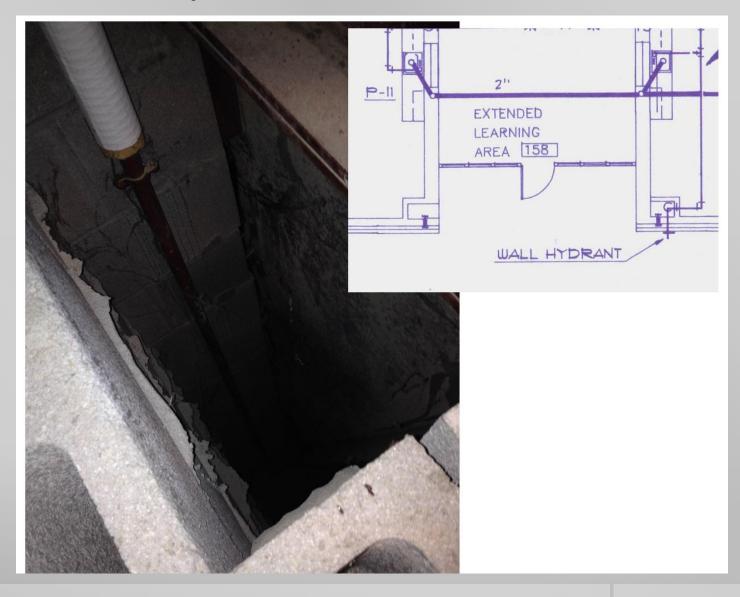
Electrical/Technology

- Tones for tornado, school emergencies, through phone/intercom system
- 59. Card access control at all entry points
- All restrooms: lights and exhaust fans on joint occupancy sensors
- Provide minimal lighting possibility for corridors, media center, cafeteria that is interfaced with owner's EMS system to enable all interior lighting to be turned off, but overridden by emergency demand
- Outside pole lights on photocell and wired to EMS; wall packs not on EMS
- 63. Gym lights: high output T8 fluorescent with occupancy sensors
- 64. Cafeteria and media center lighting on occupancy sensors
- 65. Stand-alone sound systems for gym, cafeteria, etc.
- 66. Fluorescent service lighting at all mezzanines
- 67. Universal mount telephones in all classrooms, offices, labs
- 68. Toshiba phone system with voicemail
- Computer labs: one contactor wall switch for monitor control only. CPU circuits will no longer be controlled by wall switch
- 70. Parabolic lenses only in computer labs
- Provide complete camera surveillance system, including server (consult with owner for specification), 3 cameras, one in main office and two at student loading areas
- 72. Data wiring shall meet Cat-6e standards
- 73. Emergency power provided to card reader system, intercom, servers, telephone system
- 74. Provide telephones for every room: offices, resource rooms, classrooms, media center
- 75. Computer labs have a minimum of 30 workstations plus phone and printer ports.
- 76. Provide 4 data jacks in each classroom
- 77. Provide <u>submetering</u> for: lighting, <u>hvac</u>, kitchen
- Provide sound enclosure to inhibit <u>Lightspeed</u> sound from traveling to adjacent spaces
- Work with Technology Dept. to determine how classroom TV/projection systems will be provided
- 80. No keyswitches for lighting anywhere

Building Automation Systems

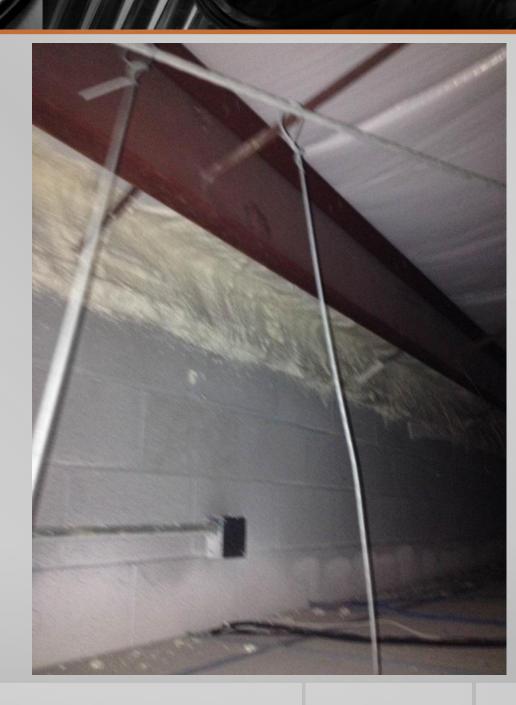
- 1984: Johnson Control System
- 1992: ACT control system
- 2007: Alerton Control System (Bacnet)
 - Installed and programmed by our own staff
- Until I was asked to serve as energy manager, the main philosophical driver was that building occupants should never feel any difference in the environment or be asked to change in any way. Savings would be achieved primarily through building enhancements, mechanical systems, and reducing waste.
- Truth is, we are still stuck in that mode of thinking, for the most part.

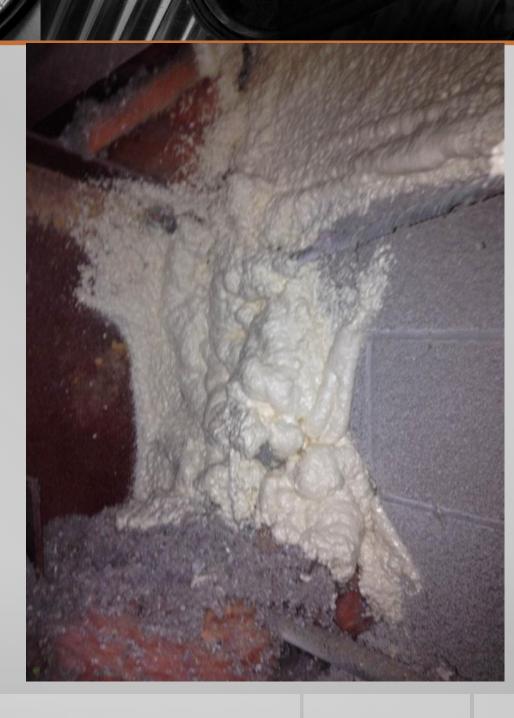
- Installing the system with our own technicians
 - Better understanding of how the system works
 - Easier to troubleshoot
 - No maintenance or service agreements
- Programming improvements
 - We are constantly improving the control programs, writing PLC logic that increases both efficiency and comfort
 - Our BAS allows integration of all types of HVAC equipment

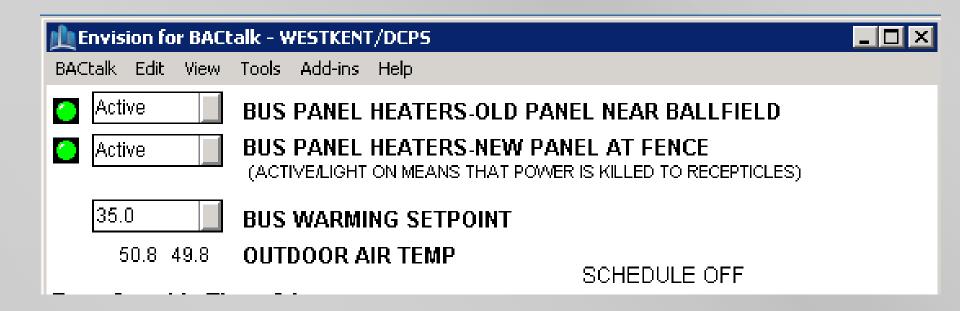












Gym Lighting

Changing out all metal halide lighting to fluorescent
 By adding occupancy sensors, this reduces gym lighting cost by 75%

HW Circulation Pumps

 Installed relays that are connected to BAS; they are turned on only when HVAC is in occupied mode

Parking lot lights

Also tied to the BAS so are turned off when custodians finish their shift

- Early warm-up
 - On extremely cold days, VRV systems need longer time to achieve correct room temp
- Natural gas fired instantaneous heat
 - When HW heaters fail, we are replacing with instantaneous heaters
- Eliminated most wall pack lighting on new buildings
- Installed humidity sensors in libraries and musical instrument storage areas

Burns Middle School Project

- Exterior wall had design flaw that allowed water to seep in at lintel
 - Removed upper brick, sprayed foam, installed new windows and re-bricked
- Replaced MH wall-pack lighting with LED wall pack fixtures



Meadow Lands 2005

Southern Oaks 2008

West Louisville 2010

Building energy efficiency features:

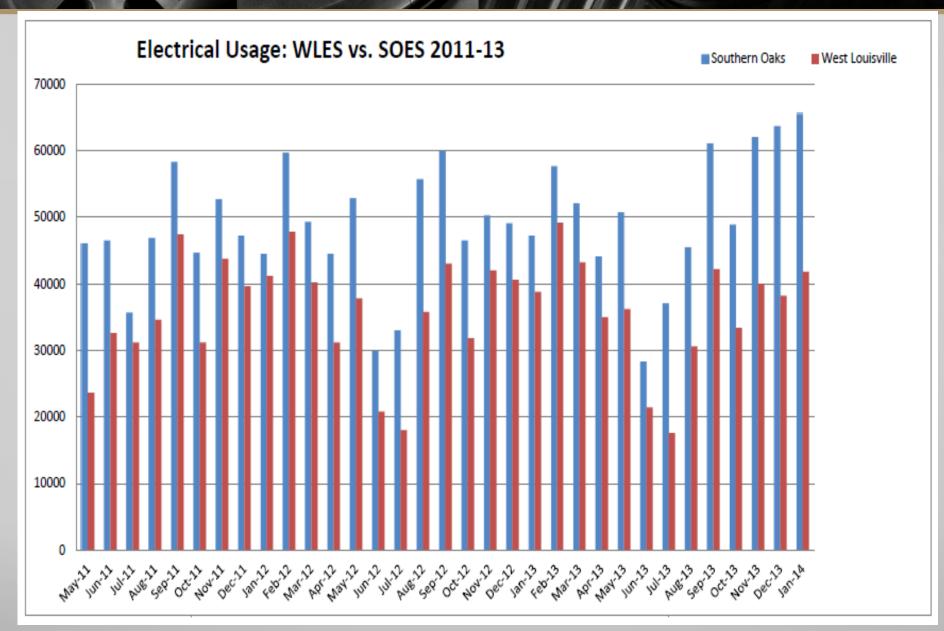
- Closed cell spray insulation over all exterior concrete block walls rather than traditional sheet insulation, also sprayed foam on interior eaves and gables to close penetrations, cracks, etc. *
- Fluorescent lighting in gym on occupancy sensors*
- Two stage geothermal heat pumps. We used centralized pumping system without redundant pumps; there are two pumps: one serves the building, the other serves the geofield. If one pump fails, there are valves in the piping system that let the other pump serve both purposes until repairs are made. This reduced installation costs. *
- Air source heat pump water heaters for restrooms located nearby so circulation pumps are not needed; these use ambient heat in the attic space to heat water.
- Gas-fired instantaneous water heaters for kitchen (2 req.: one high temp, one lower temp), *
- Occupancy sensors in almost all rooms, including closets, which eliminated the need for key-switches
- No wall-pack lighting around building, just at entrances.
- Parking lot lights are controlled by building automation system, nearly dark campus after midnight and weekends.
- Walk-in freezer and cooler are on geothermal system *
- Building automation system is very efficiently controlled; classroom hvac shuts off at 3:00, but teachers who work longer have manual override control of their classroom.*
- This building is fully DDC, Southern Oaks is zone controlled *
- No exterior wall-pack lighting on exterior of building, just at the doorways











West Louisville EUI is currently 24.4 - Southern Oaks is 35.1